

Acoustic Consultancy Report

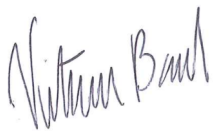
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External Plant Assessment

Report Prepared For

Maza Doner Ltd
106 Friar Street
23 August 2017

Report Author



Victoria Bond BSc (Hons) MIOA (D)

Checked By



J Niemann BSc (Hons) MIOA (D)

Telephone

0118 918 6460

Facsimile

0118 918 6480

enquiries@lcpacoustics.co.uk
www.lcpacoustics.co.uk

LCP

Riverside House
3 Winnersh Fields
Gazelle Close
Winnersh
Wokingham
RG41 5QS

A division of CAICE
Acoustic Air Movement Ltd.

Company Registration Number
2790667

VAT Registration Number
GB614683632

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i) Executive Summary

New mechanical plant is to be installed at 106 Friar Street, in Reading.

LCP has been commissioned by Maza Doner Ltd to carry out an acoustic environment survey and to use the obtained data to assess the potential noise impact of the plant installation on surrounding noise sensitive receptors.

The design criterion is as follows:

Day:	40 dB $L_{Aeq, T}$ at 37m, nearest residential;
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Night:	36 dB $L_{Aeq, T}$ at 37m, nearest residential.
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Any new mechanical plant will be installed to meet the above design criteria.

The design as proposed and assessed can achieve the required criteria provided the limiting levels detailed in section 4 of this report are implemented.

ii) Document History

Issue	Date	Issue Details	Issued By	Checked By
1	23 rd August 2017	Initial Issue	VB	JN

1 Introduction

New mechanical plant is to be installed at 106 Friar Street, in Reading.

LCP has been commissioned by Maza Doner Ltd to carry out an acoustic environment survey and to use the obtained data to assess the potential noise impact of the plant installation on surrounding noise sensitive receptors.

The guidance contained in this report is given on the basis that the operational period of the plant may potentially be continuous between 10:00 and 02:30hrs.

2 Survey

2.1 Site Description

The site layout together with the measurement position is shown in the drawing contained within Appendix A.

2.2 Receiver Location

The site was surveyed to determine the location of the most affected receiver.

The nearest receiver with direct line of sight to the plant area is along West Street, approximately 37m to the south-west of the site. This is shown in the site plan in Appendix A.

2.3 Local Noise Climate

The predominant local noise sources were road traffic, including busses, from local road networks.

2.4 Measurements

The noise monitoring took place on 11th August 2017 to the 12th August 2017. The measurement period was considered sufficient to establish the representative background sound levels corresponding to the operational period of the plant.

The weather conditions monitored during the survey are shown in the following table.

Table 1: Weather Conditions at Measurement Location

Weather	Value
Average Wind Speed	1m/s
Wind Direction	South-west
Cloud Cover	80%
Max. Temperature	20°C
Min. Temperature	16°C
Precipitation	None

2.5 Measurement Results

The measured statistical broad-band sound pressure levels are shown within Appendix B. The representative background sound level(s) obtained being as follows:

Table 2: Representative background sound levels, dB re 2×10^{-5} Pa

Measurement Position	L _{A90, 15 mins} Day*	L _{A90, 15 mins} Night*
MP1	50	46

* Day and Night periods are defined as between 07:00 - 23:00 and 23:00 - 07:00 respectively.

3 Evaluation of Design Criteria

3.1 BS4142:2014

BS4142:2014 states that the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

Table 3: BS4142 assessment based upon rating level

Difference between background noise and rating levels	Assessment
+ 10 dB	Indication of a significant adverse impact
+ 5 dB	Indication of an adverse impact
0 dB	Indication of low impact

Certain acoustic features can increase the significance of impact. The specific sound level should be corrected if a tone, impulse or other acoustic feature is expected to be present.

Table 4: Corrections for acoustic features, subjective method

Acoustic Feature	Correction, dB		
	Just Perceptible	Clearly Perceptible	Highly Perceptible
Tonality	2	4	6
Impulsivity	3	6	9
Other Characteristics	3		
Intermittency	3		

Typically the acoustic feature correction would not be expected to exceed 10dB.

Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty.

3.2 World Health Organisation Night Noise Guidelines for Europe (2009)

The WHO's document 'Night Noise Guidelines for Europe (NNG)' states the following:

"...it is recommended that the population should not be exposed to night noise levels greater than 40 dB of $L_{night, outside}$ during the part of the night when most people are in bed."

It then goes on to say:

"An interim target (IT) of 55 dB $L_{night, outside}$ is recommended in the situations where the achievement of NNG is not feasible in the short run for various reasons."

As the above guideline values consider the combined level of noise external to a façade (i.e. vehicular traffic, air traffic, building services noise etc, it is recommended that a criterion of 10 dB below these given levels is applied, depending on the particulars of the site in question.

3.3 World Health Organisation (WHO) Guidelines for Community Noise (1999)

The WHO's 'Guidelines for Community Noise' gives the following relevant noise criteria:

Table 5: Guideline values for community noise, from Guidelines for Community Noise (WHO, 1999)

Specific Environment	$L_{Aeq, T}$ dB	Time Base (hours)	$L_{Amax, fast}$ dB
Outdoor living area (serious annoyance, daytime and evening)	55	16	-
Outdoor living area (moderate annoyance, daytime and evening)	50	16	-
Dwelling, indoors	35	16	-
Inside bedrooms	30	8	45
Outside bedrooms	45	8	60
Outdoors in parkland and conservation areas*	-	-	-

* Existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low

The WHO's 'Guidelines for Community Noise' also gives the following general guidance on the expected sound insulation performance of a façade with a partly open window, it states that:

"At night, sound pressure levels at the outside facades of the living spaces should not exceed 45 dB L_{Aeq} and 60 dB L_{Amax} , so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB."

3.3.1 BS8233:2014

The criteria offered in BS8233 for residential buildings are largely based on the recommendations made in the Guidelines for Community Noise.

Using the general guidance from above, on the expected sound insulation performance of a façade with a partly open window, the criteria shown in the table below have been adapted from the criteria offered in table 4 of BS8233 in order to obtain acceptable external noise levels.

The noise levels shown should be treated as overall noise levels, i.e., the combination of all existing noise levels at the site, and noise levels from any proposed plant or activity.

Table 6: External ambient noise levels for dwellings, based on BS8233, dB re 2×10^{-5} Pa

Activity	Location	Time period	
		07:00 to 23:00	23:00 to 07:00
Resting	Living Room	50 $L_{Aeq, 16 \text{ hour}}$	-
Dining	Dining Room/area	55 $L_{Aeq, 16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	50 $L_{Aeq, 16 \text{ hour}}$	45 $L_{Aeq, 8 \text{ hour}}$

In addition to the above criteria, BS8233 goes on to say:

“For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 $L_{Aeq, T}$, with an upper guideline value of 55 dB $L_{Aeq, T}$ which would be acceptable in noisier environments.”

The above criteria are in line with the recommendations made in WHO’s ‘Guidelines for Community Noise’.

3.4 Local Authority Requirements

Reading Borough Council adopted ‘Reading Borough Local Development Framework: Core Strategy’ in January 2008, which states that *“In order to improve the quality of life of those living and working within Reading, it is important to avoid any detrimental impact from development in the form of noise and light pollution.”*

3.5 Recommended Residential Design Rating Level

On the basis of the above the design levels to be adopted for this project are set out in the table below.

Table 7: Design rating levels, dB re 2×10^{-5} Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, 16 \text{ hr}}$	Design Level (Night) $L_{Aeq, 8 \text{ hr}}$
Nearest residential	37	40	36

4 Review of Current Design

4.1 Current Design

The proposed plant shall be located to the rear of the site within a delivery yard. The proposed plant shall comprise of one supply air-handling unit and one extract fan located internally and ducted to the façade, and four condensers mounted externally on the rear façade of 106 Friars Street.

Make and model number have not been confirmed presently, therefore limiting noise levels for each item of plant has been provided in the table below.

Table 8: Guide limiting levels, dB(A) re 2×10^{-5} Pa

Plant	Limiting Sound Power Level L_{WA}	Limiting Sound Pressure Level at 1m L_{PA}	Limiting Sound Pressure Level at 10m L_{PA}
AHU supply grille	57	49	29
Extract fan grille	67	59	39
Condenser (per unit)	59	51	31

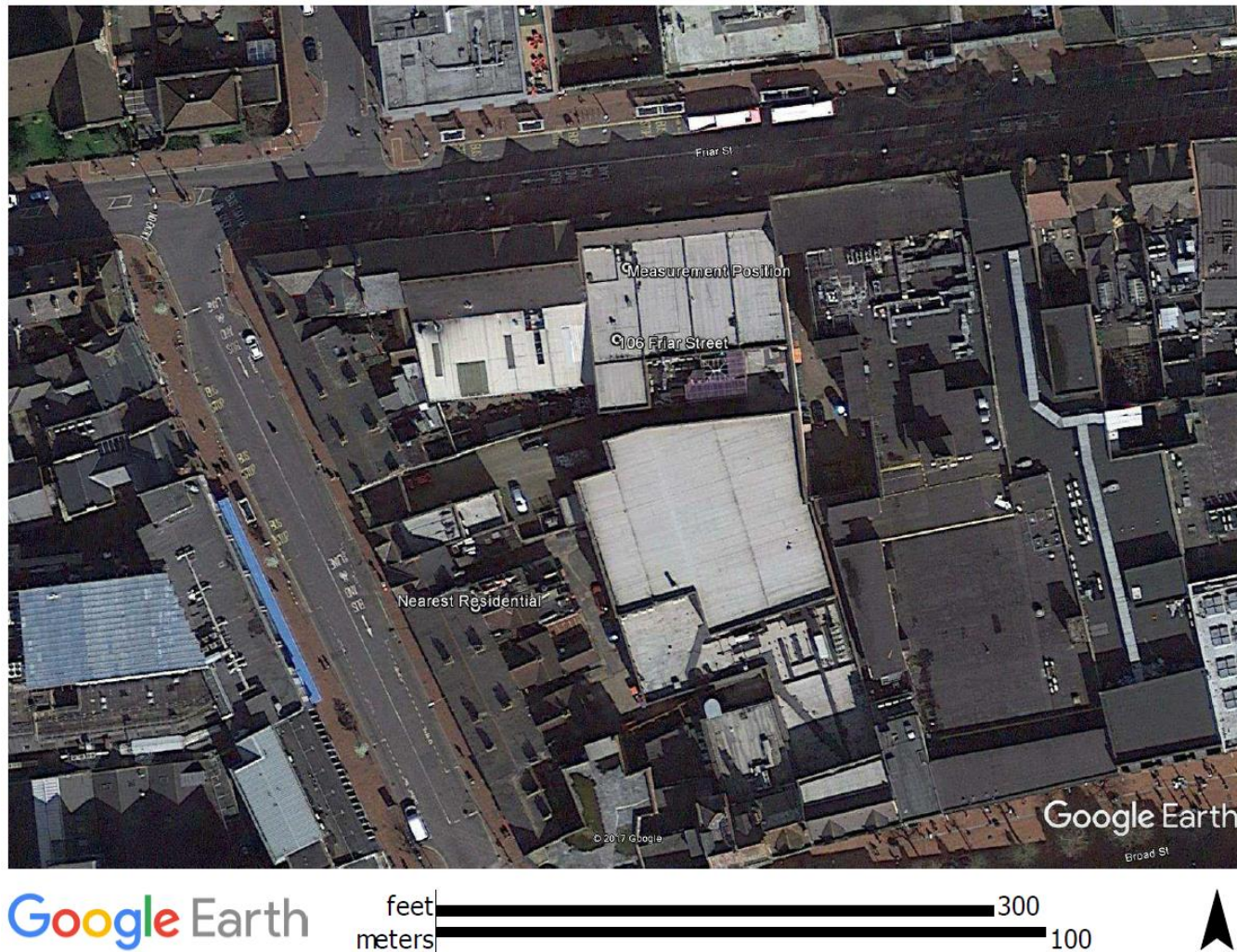
The guidance contained in this report is given on the basis that the operational period of the plant may potentially be continuous between 10:00 and 02:30hrs.

5 Conclusion

An environmental noise survey has been undertaken in order to establish the representative background sound levels local to the site generally in accordance with the method contained within BS4142: 2014.

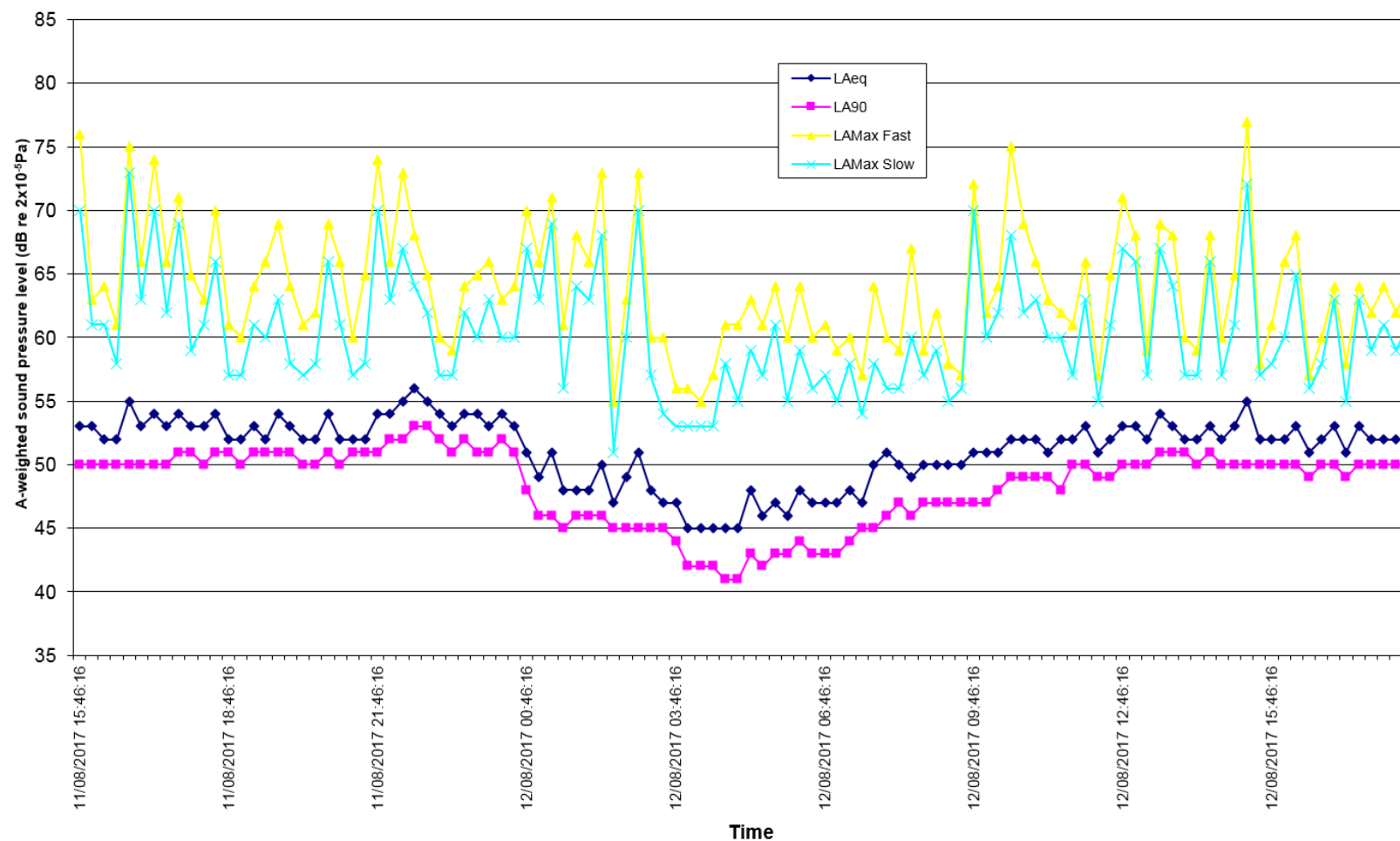
Calculations have been carried out to determine the noise levels at the nearest receiver premises. The calculations show that with the implementation the limiting levels detailed in section 4 of this report the design criteria can be met.

Appendix A: Site Plan



Approximate measurement position (Latitude & Longitude) 51°27'23.31"N, 0°58'30.18"W.

Appendix B: Measurement Data



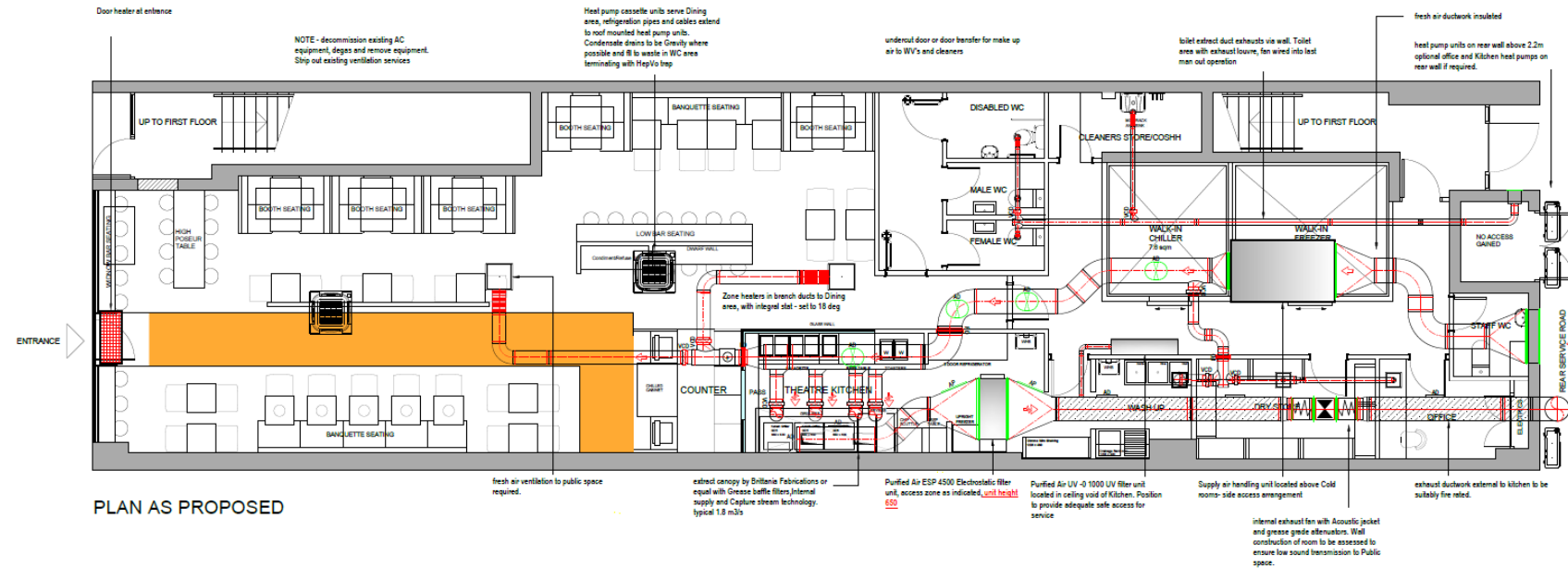
Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svantek 959 Sound Level Meter S/N: 11205
- Svantek pre-amplifier SV12L S/N: 13245 with GRAS microphone capsule 40AE S/N: 75181

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10890 complying with Class 1 specification of BS EN 60942:2003, calibration level 114.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Appendix C: Plant Location

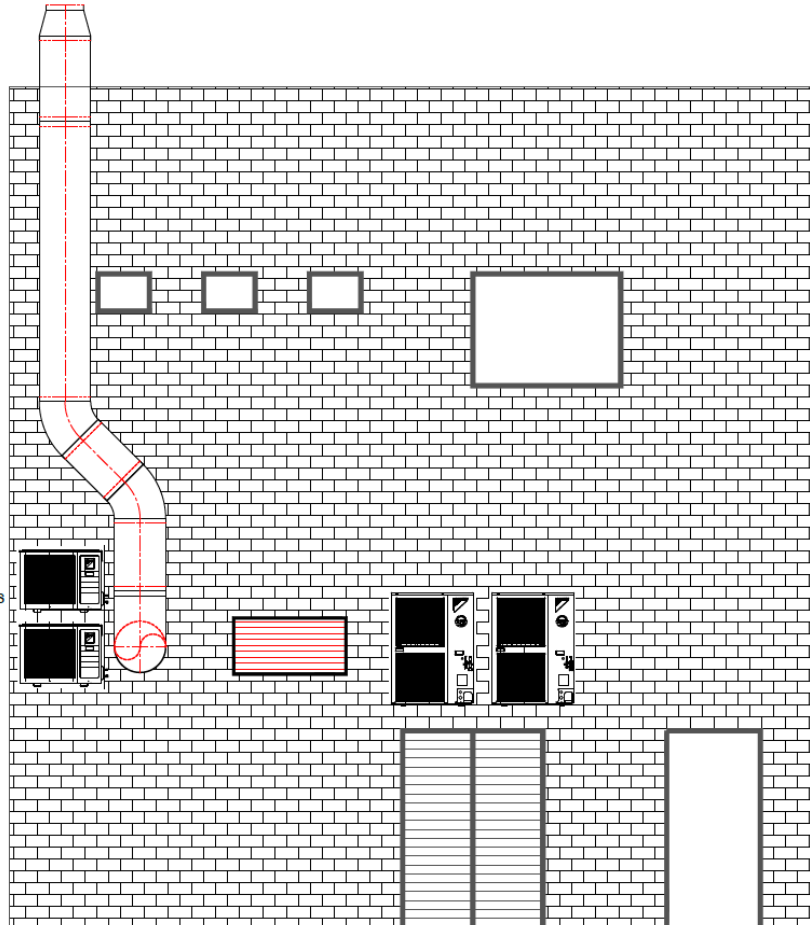
Floor plan:



Rear elevation:

exhaust duct to 1m above ridge line with
high velocity discharge terminal.

external heat pumps, drip trays with drains
piped back into WC area.





Appendix D: Calculations

Ref.	plant	Ref.dist.	Sound Level (Lp/Lw)									Lw	Reciever Distance (m)	dB(A)	Lp	No. off	dB	Angular Directionality	63	125	250	500	1k	2k	4k	8k	Façade correction	dB
			63	125	250	500	1k	2k	4k	8k	dB(A)																	
1	Supply AHU	1.00	45	46	47	47	44	40	35	35	49	57	36.0	-39	18	1	0	None	0	0	0	0	0	0	0	0	Yes	3
2	Extract fan	1.00	55	56	57	57	54	50	45	45	59	67	36.0	-39	28	1	0	None	0	0	0	0	0	0	0	0	Yes	3
3	Condenser	1.00	47	48	49	49	46	42	37	37	51	59	36.0	-39	20	4	6	None	0	0	0	0	0	0	0	0	Yes	3

Ref.	plant	Receiver Lp									Barrier Path Difference Loss:															
		63	125	250	500	1k	2k	4k	8k	dB(A)	Source height	Receiver height	Barrier height	Source to barrier distance	Barrier to receiver distance	Calculated path difference	63	125	250	500	1000	2000	4000	8000		
1	Supply AHU	17	18	19	19	16	12	7	7	21	1.0				36.0	-0.99	0	0	0	0	0	0	0	0	0	0
2	Extract fan	27	28	29	29	26	22	17	17	31	1.0				36.0	-0.99	0	0	0	0	0	0	0	0	0	0
3	Condenser	25	26	27	27	24	20	15	15	29	1.0				36.0	-0.99	0	0	0	0	0	0	0	0	0	0
Tolerance		3	3	3	3	3	3	3	3	3																
Total		32	33	34	34	31	27	22	22	36																

Criteria											Barrier SRI													
NR	63	125	250	500	1k	2k	4k	8k	dB(A)								63	125	250	500	1k	2k	4k	8k
26	56	45	36	30	26	23	21	19	36								Manual							
																	Unknown	100	100	100	100	100	100	100

Ref.	Plant	Excess									Barrier Deration															
		63	125	250	500	1k	2k	4k	8k	dB(A)																
1	Supply AHU	-39	-27	-17	-11	-10	-11	-14	-12	-15						Supply AHU	0	0	0	0	0	0	0	0	0	
2	Extract fan	-29	-17	-7	-1	0	-1	-4	-2	-5						Extract fan	0	0	0	0	0	0	0	0	0	
3	Condenser	-31	-19	-9	-3	-2	-3	-6	-4	-7						Condenser	0	0	0	0	0	0	0	0	0	
Total		-24	-11	-2	4	5	4	2	3	1																

Ref.	Plant	Mitigated Receiver Lp									Net barrier loss															
		63	125	250	500	1k	2k	4k	8k	dB(A)																
1	Supply AHU	17	18	19	19	16	12	7	7	21						Supply AHU	0	0	0	0	0	0	0	0	0	
2	Extract fan	27	28	29	29	26	22	17	17	31						Extract fan	0	0	0	0	0	0	0	0	0	
3	Condenser	25	26	27	27	24	20	15	15	29						Condenser	0	0	0	0	0	0	0	0	0	
Tolerance		3	3	3	3	3	3	3	3	3																
Total		32	33	34	34	31	27	22	22	36																

Appendix E: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Airborne Noise

Noise transmitted through air.

Ambient Noise

The total noise level including all 'normally experienced' noise sources.

dB or Decibel

Literally meaning 'a tenth of a bel', the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

30 dB + 30 dB $\neq$ 60 dB

30 dB + 30 dB = 33 dB

$D_{nTw} + C_{tr}$

The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.

D	Is simply $L1 - L2$.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.

Frequency (Hz)

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The 'A' weighted noise level exceeded for 90% of the time period T, described or measured. The '90' can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The 'A' weighted 'equivalent' noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The 'A' weighted maximum measured noise level. Can be measured with a 'slow' (1 sec) or 'fast' (0.125 sec) time weighting.

L_{Amin}

The 'A' weighted minimum measured noise level.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf} , RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to 2×10^{-5} Pa.

Subjective Effect of Changes in Sound Pressure Level

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.